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ABSTRACT

This paper, which was presented to National Aeronautics and Space Administration librarians as part of a telecommunications conference, describes features of the proposed National Research and Education Network (NREN). First, NREN's predecessor, the National Science Foundation network (the current NSFnet/Internet system), is discussed and the rationale behind NREN is explored. Secondly, the NREN proposal as embodied in the High Performance Computing Act of 1991 is described and some metaphors for NREN (e.g., interstate highways, railroads, telephone system) are examined. The arguments concerning the extent to which NREN should be publicly owned and operated or transferred to the private sector are then considered. Finally, the paper explores the social equity implications of information technologies like NREN and examines how the movement toward an information democracy might be enhanced. Reproductions of the slides shown during the presentation are appended. (30 references) (MAB)

NREN AND INFORMATION DEMOCRACY

A PRESENTATION TO THE CONTINUING EDUCATION PROGRAM FOR NASA LIBRARIANS

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May 23, 1991

NREN AND INFORMATION DEMOCRACY

Dr. Ronald D. Doctor
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May 23, 1991

Good afternoon.

Slide - National Research and Education Network

Dean Turner and I are here today to talk about NREN, the proposed National Research and Education Network. This is what we'll cover:

Slide - NREN and Information Democracy

* NREN's Predecessors, NSFnet/The Internet.

  We'll take a quick look at NREN's predecessors, the current NSFnet/Internet system.

* Why We Need NREN.

  And we'll examine the rationale for spending $1 billion on a high performance computing program that includes NREN.

* What is NREN?

  We'll describe the NREN proposal as embodied in S.272, amd H.R. 656, The High Performance Computing Act of 1991.

* Metaphors for NREN: Interstate Highways, Railroads, Telephone System.

  We'll look at some popular metaphors that are being used to characterize NREN.

* Privatized vs Public NREN

  And we'll consider the arguments concerning the extent to which NREN should be publicly owned and operated or transferred to the private sector.

* Information Technology, NREN, and Social Equity

  Finally, we'll examine the social equity implications of information technologies like NREN and explore how we might enhance our movement toward information democracy.

We are concerned with 5 key issues:

Slide - Key Issues

* Universal access to information systems
* Public vs. private ownership and operation
* Who decides what services will be available?
* Who sets rates or fees for access?
* Who pays? Who benefits?

In particular, we will discuss how the proposed NREN might be used to further, or hinder, our movement as a nation toward the realization of Information Democracy.

We'll find that the legislation that creates NREN doesn't deal directly with these issues. Instead, most of the hard decisions regarding the societal implications of NREN are postponed for at least a year. But more about that later

Introduction to Networks

Before I get too far into this presentation, let me deal with a couple of basic questions.

Slide - Basic Questions

* What is a network? And,
* Why should we be interested?

What is a Network?

Slide - What is a Network?

First, for our purposes, a network is an interconnected set of computers and the people who use them. The computers may be:

* Microcomputers like the ones many of us have on our desks
* Minicomputers like those that many library OPACs use,
* Mainframes like those that made a fortune for IBM stockholders, and
* High speed, high performance Supercomputers that are so critical for dealing with the Grand Challenges of our times: Very large scale problems in astrophysics, plasma physics, weather and climate forecasting, and neurocomputing.

Second, the networks of primary concern are Internet and its NSFnet backbone, and the proposed NREN.

Slide - NSFnet/Internet Statistics

Currently, Internet and NSFnet[1]:

* Interconnect almost 600 Colleges and Universities and about 400 other organizations worldwide;
* Support more than 3 million workstations; and
* Have traffic growing at about 15%-20% per month

Why should we be interested?

The second question, "why should we be interested", is a little harder to answer, because the response must take our individual preferences into account. But let me give it a try.

We should be interested in these networks because:

Slide - Why should we be interested?

* The existing Internet network has a wealth of resources on it that can help us do our jobs better.
* By using the resources available on Internet we can enrich our personal and professional interests.
* Internet currently is quite elitist. Only a couple of million people have access to it, but an expanded system has the potential for changing our society and moving us toward Information Democracy.
* Further development of the NSFnet backbone will help enhance America's competitiveness in world commerce
* The Federal Government is getting ready to spend more than a billion dollars on the Network.

What activities and resources are available on Internet?

Slide - Worldwide activities on Internet

Activities on Internet fall into 4 primary categories[2,3]:

* Electronic mail and messaging allow us to communicate 'freely' with anyone in the world who has an Internet E-mail address or is connected to a system that links to Internet.

* Internet contains thousands of discussion forums in which people can exchange views and information on a wide variety of topics.
* Internet allows us to transfer computer files containing text, image, sound, or video to or from any other connected computer.
* Through Internet we can connect to and use distant computer systems. Scientists and industrial firms have access to distant supercomputer facilities. Librarians and others can connect to and use any of more than 200 University and Public Library Online Catalog systems. And anyone with an Internet account can connect into more than 20 campus-wide information systems.(4)

I can only hint at the rich resources available on Internet. There are literally *thousands* of discussion forums and they cover just about all conceivable interests(5).

Slide - Internet Forums for Librarians

Here are 31 that are of special interest to librarians(6):

Art Libraries Association of North America
Bibliographic Instruction
BRS/Search Users
Business Librarians
Campus-Wide Information Systems
Circulation and Access Services
Conservation of Archive, Library, and Museum Materials
Data Research ATLAS Users
Discussion of Library Reference Issues
Geac Advance Library System
Government Documents
Innovative Interfaces Users
Interlibrary Loan
Law Librarians
Library Administration and Management
Library Automation in Greece
Library Cataloging and Authorities Discussion Group
Library Planning
Maps and Air Photo Forum
Medical and Health Sciences Libraries
Music Library Association
NOTIS Acquisitions Discussion Group
NOTIS and Other Rare Book Catalogers
NOTIS Music Library List
NOTIS Users
Public-Access Computer Systems Forum
Rare Books, Manuscripts, and Special Collections

Serials Users Discussion Group
SPIRES Users
Virginia Tech Library System Software
Z39.50 Implementors Workshop

In addition, a growing number of electronic serials are available online, as well as more and more works of literature, handbooks and manuals that are in the public domain. Some of these include:

* The King James Bible
* The CIA's World Factbook
* The works of Lewis Carroll
* Biomedical Abstracts
* Full text of Supreme Court Opinions

And, if you are affiliated with an organization that is connected to Internet, most of these services probably are available to you at NO COST.

Internet has become so heavily used that it is overloading. Since so much of its use is considered important in maintaining America's competitive edge in world commerce, the Federal Government is considering a major commitment to upgrade NSFnet, the Internet backbone. The result would be NREN, the National Research and Education Network.

NREN, as presently conceived, would be part of a billion dollar, five year high performance computing initiative. The High Performance Computing Act of 1991, S.272, initially sponsored by Senator Albert Gore, has gained Senate Commerce Committee approval and soon will be considered by the full Senate[7,8]. A competing bill, S.343, has been reported out of the Senate Energy Committee. Reconciliation of the two Senate bills is proceeding.

A companion bill in the House, H.R. 656, has been approved by the House Science Committee[9], and was referred to the House Education and Labor Committee. The House bill was reported favorably by the Education and Labor Committee today, and next will go to the House floor. Final action on both the Senate and House bills is expected by mid-June. After passage by the Senate and House, differences between the two bills will be resolved in a Joint Conference Committee.

To understand how NREN is being shaped by political pressures, and how the proposed bills deal with social equity concerns, we first must understand how NSFnet and Internet came about.

How NSFnet/Internet came about[10]

In the 1960s, the Department of Defense created a telephone-based network to interconnect the computer systems of key researchers at defense contractors, military installations, and selected educational/research institutions. This massive network was operated by the Advanced Research Projects Agency (ARPA), and became known as ARPANET.

Slide - Development of the 'Backbone Network'

ARPANET was designed to ease communication among these researchers and enable them to share relatively scarce computer resources. The network grew rapidly and message traffic expanded greatly as researchers learned they could communicate more effectively over the electronic network than via telephone or mail. Regional networks hooked onto ARPANET and soon the network approached saturation.

The issue of network capacity, or speed, or bandwidth is important for understanding the need for NREN.

Network Capacity, or Bandwidth

In the 1970s, ARPANET operated at a 'speed', or bandwidth of 56,000 digital bits per second. Bandwidth is a measure of how much capacity the network can handle. As network traffic increases, and as the kinds of things being done on the network increase in complexity beyond simple messaging, the network needs to be upgraded to provide greater bandwidth.

We can liken network bandwidth to the number of lanes on a freeway. As traffic on the freeway increases, speed must decrease and congestion becomes intolerable. One solution is to add more lanes. In the same way, we add lanes, or bandwidth, to the national telecommunications network.

So, when ARPANET needed additional capacity, it was upgraded. In the process, recognizing that more and more network traffic involved non-Defense, scientific transactions, the National Science Foundation was given responsibility for administering the network. The new 'backbone' to which a whole variety of regional and special purpose networks were connected, became known as NSFnet.

Slide - Capacity of 56 Kbps & T1 Networks

By 1987, this NSFnet backbone was fully upgraded to operate as a "T1" network, at 1.5 Mbps, 28 times 'faster' than ARPANET.

Gradually, the regional and special purpose networks connected to the backbone also upgraded to T1 lines. The entire complex of the NSFnet backbone and the various networks connected to them is known as the Internet.

By 1990, only 3 years after the T1 upgrade, another upgrade was required, and it is being completed this year. It uses T3 lines and operates at 45 million bps, another 28-fold increase over the T1 system. And again, the connecting networks also will upgrade.

Slide - Capacity of 56 Kbps, T1 & T3 Networks

But the handwriting is on the wall. It is clear that a drastic overhaul of the backbone is necessary, and that the network now is so essential to the national interest, that the Federal government will have to commit significant funds to its improvement. The High Performance Computing Act of 1991, S.272, provides for these improvements. NREN, the new backbone provided for in S.272, would operate at several billion bps, about 66 times faster than the T3 backbone.

Slide - Capacity of 56 Kbps, T1, T3, 3 Gbps Networks

What does this speed mean in practical terms? Karraker[11] notes that:

* In medicine it means, we can transmit 100 3-dimensional x-rays or catscans in *one* second.
* In the space program, it means we can send 1,000 satellite photographs across the network in *one* second.
* In libraries, it means we can transmit the equivalent of the entire Encyclopedia Britannica in *one* second, more than 100,000 typed pages per second.

Additional speed, or capacity, also means that many more computers can be connected to the network and many more people can benefit from it. The goal of Universal Service, or Information Democracy, may be within our grasp ... <u>if</u> network capacity can handle it and <u>if</u> the political system allows for it.

In terms of <u>technology</u>, we have moved a long way toward that goal during the past five years. In July, 1987, the network looked like this[12]:

Slide - Map of the network in July 1987, from NSF Network News

By February 1991, the Network had expanded dramatically[13]:

Slide - Map of the network in February 1991, from NSF Network News

We can get a glimpse of the intricacies of interconnection by taking a look at the Texas Higher Education Network (THEnet)[14].

Slide - Texas Higher Education Network (THEnet), 1991

In 1991, THEnet was a web of interconnected colleges and universities, and government and industrial facilities, and it included a link into Mexico. Speed and capacity of the network range from a meager 9.6 Kbps to T1 capacity at 1.5 Mbps, depending on where you are in the system. The entire network is linked to the NSFnet backbone through a node in Houston. This gives Texans who are fortunate enough to have network access, the ability to tap into communication, information and computer resources all over the world.

The potential applications of such a widely distributed, decentralized and interconnected system stagger our imaginations.

What is NREN?

As mentioned earlier, the High-Performance Computing Act of 1991, S.272, introduced by Senator Albert Gore and others was the subject of a single hearing on March 5th before the Senate Committee on Commerce, Science, and Transportation. The bill was approved by the Committee, essentially unchanged from its March, 1991 form, and now will be considered by the full Senate. A companion bill, H.R. 656, sponsored by Rep. George Brown is being considered in the House.

We'll focus on S.272, but I'll also point out the most important differences between it and H.R. 656. Here are some of the things S.272 would do:

* Require development of a 5 year, National High-Performance Computing Plan.

  The Federal Coordinating Council for Science, Engineering and Technology guided by the President's Science Advisor, as Director of the Office of Science and Technology Policy (OSTP), would be responsible for developing the Plan. The Plan would be due in 1 year. It is to include development activities and proposed budgets for NREN.

  Instead of a 5-year plan, the House bill requires annual reports from OSTP.

* Establish NREN as a "multi-gigabit-per-second" network by 1996.

  NREN is to "link research and education institutions, government, and industry, in every State". The National Science Foundation (NSF) is to coordinate "*deployment*" of the Network and is to ensure connections to the network for colleges, universities, and libraries. But the Council, not NSF, is to "oversee operation and evolution of the Network" and "develop conditions for access to the Network".

  The House bill places responsibility for "managing" the network in NSF instead of OSTP.

* Phase the Network into commercial operation "as commercial networks can meet the networking needs of American researchers and educators".

  Privatization of NREN is, perhaps, the most controversial and complex of the Bill's provisions. The Council, which is responsible for Network operations and evolution, will develop "plans for eventual commercialization of the Network" (e.g. how privatization is to be accomplished, under what conditions, and with what safeguards for the public interest). And it will be the Council also that provides for the interests of Americans other than "researchers and educators". But guidelines for the Council's activities are left unspecified by the Bill.

  H.R.656 does not explicitly mention commercialization. Instead, it limits government's role to network management (which in turn, may be contracted out to private sector firms). Under the House bill, network services would be purchased from the private sector, thus approximating current Internet operations.

* Provide for access to "electronic information resources maintained by libraries, research facilities, publishers, and affiliated organizations".

  The Council would be responsible for developing "conditions for access to the Network", and for establishing a system of user charges.

  The Bill envisions an accounting system by which users would be "charged for their usage of the Network and copyrighted materials available over the Network". There will be little argument about charging for copyrighted materials. But, depending on the magnitude and distribution of fees, imposing charges for network usage

may be a significant departure from the historic practice of "free" access.

H.R.656 explicitly recognizes the need to extend network access to *all* Americans and educational institutions at *all* levels.(15).

* Allow the use of Federal research "grant monies to pay for networking expenses".

  This provision continues a long-standing tradition of supporting the Network with Federal research grant funds. The difference is that the new Network ultimately will be in commercial hands. Thus there will be continuing Federal support for a Network developed with tax dollars.

* Expand NSF's role in research and training in the library and information sciences.

  NSF's expanded role would include promoting development of information services that could be provided on the Network. These services would include unclassified Federal data and access to commercial information services.

* Authorize appropriations of $1.019 billion from FY 1992 through 1996 for the High Speed Computing Program (HSCP).

  Of this amount, $195 million would be authorized to NSF for NREN, beginning with $15 million in FY 1992. A total of $650 million would go to NSF, $338 million to NASA, and $31 million to the National Institute for Standards and Technology.

  H.R.656 authorizes appropriations "from sums otherwise authorized" that total $2.892 billion. Of this, $1.547 billion is for NSF, $666 million for DOE, $609 million for NASA, and $70 million for EPA.

Well, perhaps my concerns for the lack of social equity considerations in S.272 are merely quibbles. Perhaps these concerns will be dealt with as the Council, OSTP, and NSF proceed with their work. But perhaps they won't.

Social equity concerns are not explicitly mentioned in S.272, and barely alluded to in H.R.656. Nor is there any explicit requirement to ensure equitable access to the Network for schools below the college and university level. S.272 seems to be deliberately ambiguous with regard to these issues, just as it is ambiguous in dealing with the 'eventual commercialization' of the Network.

Apparently, what we are dealing with here are the realities of the legislative process. The sponsors of S.272 have crafted a Bill that moves us forward *technologically* and that they believe can pass the Congress and be signed by the President. They have left *societal* aspects of the issue to be decided at a later date. An Executive Branch body, the Office of Science and Technology Policy, through its Federal Coordinating Council for Science, Engineering and Technology (FCCSET, pronounced Fixit) is the designated instrument for making the hard implementation decisions.

The Plan that the Council drafts will be a complex policy instrument. Provisions of the Plan that directly affect the library and information science community include requirements to "identify how agencies and departments can collaborate to":

* Distribute federally-funded software to State and local governments, industry, and universities;
* Distribute Federal agency data bases and information; and
* Provide for educating and training additional undergraduate and graduate students in software engineering, computer science, library and information science, and computational science.

S.272 lays some very heavy responsibilities on the Council. This Council, although relatively unknown, carries the burden for assuring equitable and affordable access to information and communication resources. Lacking congressional guidelines, we must await the Council's deliberations to learn how, or whether, we will move along the path toward Information Democracy. Nevertheless, it will be useful to explore the outlines of some possible paths.

Information Technology, NREN, and Social Equity

I've alluded to social equity and information democracy several times. Why do we need to be concerned about social equity?

> Slide - Bacon: Knowledge itself is power
>
> Nam et ipsa scientia potestas est
> Knowledge itself is power
> Francis Bacon, 1597

Francis Bacon wrote a much quoted aphorism: "Knowledge itself is power"(16). If the flow of information leads to knowledge, then control of information flows, leads to control of societal power. That's why many of us are so concerned about ensuring Information Democracy.

The Congressional Office of Technology Assessment (OTA) says:

> "The opportunity for people to participate in economic, political, and cultural life depends on their ability to access and use communication and information services. Individuals need skills and tools to locate the communication pathways, information, and audiences in a timely fashion and in an appropriate form. Unequal access to communication resources leads to unequal advantages, and ultimately to inequalities in social and economic opportunities."(17)

Who are the 'people' likely to be left out of a commercialization approach to the new telecommunications superhighway? The Alliance for Public Technology provides us with these population statistics(18).

Slide - Demographics and Equity: Special Populations

Out of 240 Million Americans:

- 27% (64.8 million) live in rural areas
- 14% (32.4 million) are below poverty level
- 24% (58.4 million) are in school
- 12% (29.8 million) are over 65 years of age
- 11% (27 million) over age 16 are disabled

These are the people who are most threatened by the consequences of unequal access to information resources.

Slide - OMB Projections

In 1989, the Federal Office of Management and Budget (OMB) forecasted that by the year 2000, almost two-thirds of American households will own personal computers; and 6-8 million businesses and 40-50 million households will have electronic access to databases containing information on available products and services from private and public organizations.(19)

The OMB report, (and the literature generally) is silent about what happens to the other one-third of US households that do <u>not</u> have computers, are unlikely to obtain them, and, presently, wouldn't know what to do with it if they had one.

The *distribution* of computer ownership and use across socioeconomic groups is even more important than aggregate numbers of computer users. Various surveys and questionnaires since 1981 are remarkably consistent in the picture they paint:

Slide - Computer Ownership and Use - Social Impacts

1. Dutton, Rogers and Jun in a 1987 review of 11 earlier surveys[20] found that microcomputers provide a significant educational advantage to children. They also found that these advantages are unequally distributed across economic, ethnic and gender categories[21,22,23].

2. Kominski's 1988 report of a 1984 Census Bureau survey indicated lack of access to computers by school age children was correlated to family income and linked to race and education[24].

   a. 37% of children in families with incomes of more than $50,000 have computers in their homes.
   b. Only 3.4% of children in households with income less than $10,000 have computers at home.
   c. 17% of all white children, 6% of blacks and less than 5% of Hispanics use a computer at home.
   d. But, given the opportunity, black children use computers at home much more than their white counterparts. White children used home computers on average 2.8 days/week, black children averaged 3.8 days/week.

   The Census Bureau noted that "for children at the lower end of the economic spectrum, lack of access to computers during their school years may further limit their employment opportunities as adults."[25]

3. A 1988 report by the Educational Testing Service (ETS) found that computer ownership and use divides along income and ethnic lines[26].

   They found clear ethnic differences in computer competence, favoring White students over Black and Hispanic youngsters. Much of the difference derived from different levels of access to computers in school and availability of machines at home.

4. The ETS study also found that student competence with computers correlates strongly with the level of parental education, and with attendance at non-public schools.

   The higher the parents' education level, the more likely the children were to be currently studying computers in school and to have a computer at home. Parents who graduated from college were about twice as likely to own a computer as high school graduates, and 3 times as likely as those who didn't finish high school.

Families whose children went to non-public schools were more likely to have a computer in the home, and to demonstrate superior competence.

5. Unequal access also results in a structural gap between rural and urban areas in the US[27,28].

   In the ETS study, students from advantaged metropolitan areas were the most computer competent. Students from rural and disadvantaged metropolitan areas were the least competent.

   The most important factor affecting computer competence across communities and regions was family ownership of a computer. About half of 7th graders in advantaged metropolitan areas own computers. But only one in five of their *rural* peers have home access to a machine.

These and other data point to computer ownership and availability of school-based instruction as primary determinants of competence. And these in turn are strongly correlated to income and affluence.

In our system of government, diffuse economic and social forces determine access to knowledge. The power associated with possession of knowledge is limited to those who have the economic resources to acquire access to the new technologies and are in a social environment that enables them to use that access effectively.

If a socioeconomic group does not possess the *training* to use computer and telecommunications technologies *effectively*, then the power of those technologies is denied to them. The ability to use a technology includes not only individual skill and intelligence, but social organization as well. If the social organization of the user (or user group) does not facilitate effective and timely use, much of the power of the technology may be dissipated.

So, we see that whether the 'gap' indicated by recent surveys will grow or narrow over time depends on our educational and social policies and programs. NREN is one such program. It will be a serious strike against information democracy and our movement toward social equity, if NREN is structured in a way that widens the existing information gap.

Metaphors for NREN: Highway, Railroad, Telephone

Slide - Metaphors for NREN Development

Various metaphors have been put forth in efforts to untangle the possible modes of NREN organization. Senator Gore likens NREN to the Interstate Highway System that his father was so instrumental in developing. Others see parallels to the railroad system of the last century, or the telephone system of this century. We may be able to clarify some of the contending philosophies by considering these metaphors.

The Railroad Metaphor

Roger Karraker[29] points out that in the 19th century the federal government encouraged the nation's westward expansion by giving monopolies and land rights to the railroads. Exactly where the new railroads would be built, and what towns would have stations was left to private interests. Towns, industries and farms with railroad access prospered. Those without, withered.

Slide - The Railroad Metaphor

- Private sector ownership and operation.
- Private sector development and funding.
- Development timetables and access rules e tablished private sector.
- Rates, services and fees set by private sector.

Under the railroad metaphor, construction of the telecommunications network, and decisions regarding access to it, would be left entirely to private enterprise. The federal government would bless the arrangement with non-intervention, laissez-faire policies.

The network would be built and maintained with private sector funding. But, initially, at least, the network revenues would come primarily from federally supported research institutions.

From an information democracy viewpoint, the railroad model yields a worst case scenario.

The Highway Metaphor

The interstate highway system provides another metaphor for NREN. This is a compelling metaphor, one which captures the imagination. Let's see if the metaphor offers social equity guidelines for implementation of NREN.

As you know, the interstate highway network had a very long gestation period, and not an easy birth.

Slide - Cover of Mark Rose's book

There was a great deal of politics involved in its development, a story that Mark Rose has captured in his book, *Interstate: Express highway politics, 1939-1989*(30). In addition, there have been numerous studies carried out to determine the social and economic effects of building highways.

I'll concentrate on what happens when a town is bypassed by a new highway. I am sure that any of you who travelled highways before, during, and after the interstate highway system was built, bear firsthand witness to what the economic and sociological studies have found.

We'll consider a town that is served by a federal highway. This highway connects the town to its neighbors and to centers of activity far beyond its boundaries. When authorities build a new interstate highway that parallels the old highway, we can classify the impacts according to the degree of access to the new highway, or conversely, by the degree to which the town is bypassed.

The first category we'll consider involves a town that is completely bypassed by the new interstate highway. No access to the new highway is provided.

Slide - No access to bypassed town

It makes intuitive sense that a town in this situation will be fundamentally altered, both socially and economically. Many small rural towns are in this situation. Although we like to harbor the myth that poor rural towns like this are somehow morally superior, the impact of complete bypass is largely negative.

In the second category, the town is provided with access to the new interstate.

Slide - Access is provided to bypassed town

Although access yields many positive impacts, there are significant negative impacts as well. Impact differs for different types of business activity. Let's see if we can draw lessons for NREN from what we know about the economic impact of this type of bypass/access system.

Slide - Economic Impact of Access

In assessing and predicting the impact of interstate highway access to a rural community, the interdependencies of various spending units within a local economy must be considered. This involves studying the dollar flow within the local economy. As an example, if access to an interstate highway allows a local farmer to get produce to market more efficiently, the farmer will realize an increase in disposable income. The farmer probably will spend that increased disposable income in the local community. Each additional dollar the farmer puts into the economy will be respent several times, mostly in the local economy.

The multiplied local impact resulting from the farmer's greater efficiency most likely will be greater than the impact of the increased dollars that a restaurant may earn from the presence of the interstate highway. The restaurant's additional receipts are likely to be used to buy supplies in a distant city. Consequently, the local community loses the economic benefit of much of the restaurant's increased business.

Now let's try to extend the farmer-restaurant situation to NREN and see how it affects different types of libraries.

Slide - Impact of Information Access

Connecting and providing access to public and school libraries probably will have a much greater multiplier effect than connecting to academic libraries. This is because the information from public and school libraries is more likely to flow into the community and be shared among members of that community. That is, users of public and school libraries are likely to remain in the community, applying locally what they have learned there. Users of academic libraries however, are likely to move on, taking much of what they have learned on the information superhighway with them.

This is not to say that connecting to academic libraries and research centers is not critical. It is. The important point though, is that the potential of schools (including community colleges) and public libraries to multiply the local impact of the information superhighway, may be greater than that of the academic library.

In examining social equity and planning considerations for NREN, we could carry the interstate highway analogy even further. We could examine the divisive, isolating effect of

a new highway that is built through the middle of a community. We could examine the increased 'gap' that a new highway creates between those who own vehicles and can use the highway effectively and those who are 'vehicle poor'. We could consider the usage and demographic effects of pay-per-mile toll highways.

These 'social equity' aspects of the interstate highway metaphor are critically important as we move along the political path that will create the new superhighways of information. But these aspects of NREN are not much discussed by those proponents of S.272 who suggest that the bill is based on the interstate highway metaphor.

The Telephone Metaphor

The interstate highway metaphor tends to break down when we consider issues of ownership and commercialization of the information superhighway. It may be that the regulated and deregulated telephone infrastructure provides a more useful metaphor.

Under the provisions of S.272, the Federal government plays a catalytic role, "jump-starting" the telecommunications highway infrastructure with federal tax dollars. Ultimately, the system would be phased into commercialization.

Whether or not a commercialized NREN would be subject to regulation is an open question. Although the sponsors of the bill have suggested that a regulated system is their intent, there is nothing in the bill, as it presently stands, that would require public interest regulation of the NREN. Neither does the legislation define what *commercialization* means. It will be up to the Council, or future legislation, to clarify the concept.

A key feature of America's telephone system is its mandate for 'universal service'. The principle of *universal service* was imposed by the Communications Act of 1934. Under universal service,

* Telephone service should be available to everyone, regardless of income, or whether they live in an urban or rural area; and
* Rates for local telephone rates should be affordable.

As a result 94% of American households have telephones today, and most states require some sort of 'lifeline rates' for low-income households.

> A telecommunications network built along the lines of the 'telephone metaphor' would extend the principle of universal service to computer-based telecommunications. This could require amending the Communications Act of 1934, a task that entails enormous political complexity.

These three metaphors can provide important lessons for implementing NREN. As a matter of political reality, however, the metaphors are not likely to be explored in depth prior to passage of legislation that creates NREN. It will be left to the implementing agencies to analyze the various ways of structuring NREN, and to take account of social equity considerations in suggesting a preferred structure. What we must do now, before NREN is fully embodied in law, is to ensure that the legislation provides for suitable public representation in the planning and structuring process.

Actions for Activists

Although the Senate version of the High Performance Computing Act of 1991 has already been reported out of committee, there still will be opportunities for the Library and Information Science profession to affect the shape of NREN. That input can take two forms:

* Input to the continuing legislative process; and
* Input to the Executive branch agencies that will implement the provisions of an enacted Bill.

With regard to the legislative process, there may be additional hearings in one or more House committees before a House version of the Bill reaches the floor. Other points at which changes in current legislation that may occur include amendments from the Senate or House floor, modifications made by a Senate-House conference committee to reconcile the two versions of the Act, and reconciliation of S.272 with a competing Bill, S.343. As noted earlier, the latter places primary responsibility for the network in the Department of Energy.

Equally important, new legislation can be developed to fill in gaps or to clarify policy ambiguities in the existing Bills. Of necessity, this is a longer term process, but it is a process that should begin shortly after passage of the current legislation.

Both S.272 and H.R.656 provide that the President's Office of Science and Technology Policy (OSTP) shall be responsible for developing the rules under which the network will operate and evolve. One way to enhance the chances that social equity concerns are factored into NREN design is to provide for public

sector and LIS representation on the advisory bodies that will assist OSTP.

Consequently, it is important that the Library and Information Science professions develop a consensus, *now*, regarding the structure, implementation, and evolution of NREN. Here are six suggestions that would enhance NREN's ability to move us toward greater information democracy.

Slide - Actions for Activists

1. Amend the legislation to provide for public interest representation on any Advisory Committees associated with designing and implementing NREN.

   The underlying problem here is that the Bill contemplates only technical advice, and doesn't provide for advice on how to mitigate societal impacts of NREN. Expanding public and LIS representation on the advisory bodies would help deal with this problem.

   There are at least two places in S.272 that require amendment. First, Sec. 701 (b)(4) requires the Council to consult with "research, educational, and industry groups, *conducting research on and using* high performance computing" [emphasis added]. This wording should be amended to include *professional groups*, like ALA and ARL, and should not be limited to seeking advice from researchers and users of high-performance computing; Second, Sec. 701 (c) directs OSTP's Director to establish an advisory committee "of prominent representatives from industry and academia who are specially qualified ...". An amendment should add public sector and LIS representatives to the advisory committee.

2. Incorporate the concept of *Universal Service* in NREN design and implementation plans.

   Universal telephone service has served the nation well. Universal service provisions should ensure the fundamental right of all people to personal access to, and the right to *benefit* from the network. It is important that the network be designed, from its inception, to incorporate the concept of universal service. Modifying network design and operation to deal with social equity issues as an afterthought could be prohibitively expensive. These rights could be embodied either in new legislation, or in the implementation plans for NREN.

3. Develop explicit provisions for free, or very low cost local access to the network through public and school libraries, K-12 classrooms, and non-profit organizations.

   Provisions for physical access to the network will be of little use if the cost of using the network is beyond the means of users. Development of fee schedules for use of the network, should include special provisions for affordable access for small schools and libraries, rural areas and the economically disadvantaged.

4. Ensure that network development includes activities that create interfaces and applications that are useful to and usable by non-technical people.

   As currently structured, the Internet and plans for NREN serve an elite minority in the nation. We need to move in the direction of universal usability for the network. This requires special efforts to develop useful and usable interfaces, and to ensure that the network will carry applications that can help the non-computerized general public obtain information for dealing with everyday problems.

5. Develop and provide training and assistance programs to help the general public learn how to use the network effectively.

   Access, even low cost access, will be of little value if the targeted user is not sufficiently motivated or doesn't know how to use the network effectively. Training programs and programs that demonstrate how the system can be useful for dealing with important problems should accompany network implementation.

6. Ensure that there is appropriate public sector oversight of private operations when the network eventually is commercialized.

   The measures that are appropriate will depend on whether "eventual commercialization" means private sector ownership or contract operation by a private sector firm. Public sector regulation may an appropriate oversight mechanism in the case of ownership. Legislative review of operating contracts and accomplishments may be appropriate in the case of contract operations. In either case, since the network is critical to the national interest, and since its operation has long-term implications for achieving information democracy in the nation, some form of public oversight will be necessary.

Concluding Remarks

So far, proponents of NREN have been concerned almost exclusively with the technical and related institutional issues involved in its creation. Social concerns have surfaced only recently . It is important for the nation, and for our profession that the societal issues we've discussed here move to greater prominence as NREN implementation moves forward.

Great interest is developing in the concept of universal service for a national telecommunication/telecomputing system like NREN. If S.272 becomes law in its present form, much of this interest will focus on the implementation activities of NSF and OSTP, or perhaps on a movement to modify the Communications Act of 1934. For now, however, it appears that social equity concerns, and concepts like universal service will be set aside, temporarily, in recognition of the political realities surrounding the NREN legislation.

There is no doubt that the nation needs to maintain scientific leadership, and that NREN is vital to that interest. But as a nation, we also must find a balance between technological needs and social needs. Just as the library and information science community helped to broaden the provisions of S.272, our profession also must try to affect OSTP's and NSF's deliberations as it structures NREN. Our efforts, along with those of other groups concerned about the need for information democracy, will focus on the right of all people to BENEFIT from access to the network.

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SLIDES

NATIONAL RESEARCH AND EDUCATION NETWORK

NREN AND INFORMATION DEMOCRACY
WHAT WE'LL COVER TODAY

- NREN's Predecessors, NSFNET/The Internet
- What is NREN?
- Information Technology, NREN and Social Equity
- Metaphors for NREN: Interstate Highways, Railroads, Telephone System

KEY ISSUES

- Will the Network embody a *Universal Service* Principle?
- Who will own and operate the network?
- Who decides what services will be available?
- Who sets rates or fees and conditions for access?
- Who pays? Who benefits?

BASIC QUESTIONS

- What is a Network?

- Why should we be interested?

WHAT IS A NETWORK?

A network is an interconnected set of computers and the people who use them.

The computers may be:

- Microcomputers
- Minicomputers
- Mainframe Computers
- Supercomputers

NSFNET/INTERNET STATISTICS

- Interconnects 600 Colleges and Universities and 400 other Organizations
- Supports more than 3 million workstations (people)
- Traffic growing at about 20% per month

WHY SHOULD WE BE INTERESTED?

- Help us do our jobs better
- Enrich our personal and professional interests
- Currently elitist, but has potential for 'Information Democracy'
- Enhances America's Global Competitive Position
- Federal Government about to commit over $1 Billion

WORLDWIDE ACTIVITIES ON THE INTERNET

- Messaging via Electronic Mail
- Open Forum Discussion Groups
- Transfer Computer Files
- Use Distant Computer Systems

INTERNET FORUMS FOR LIBRARIANS

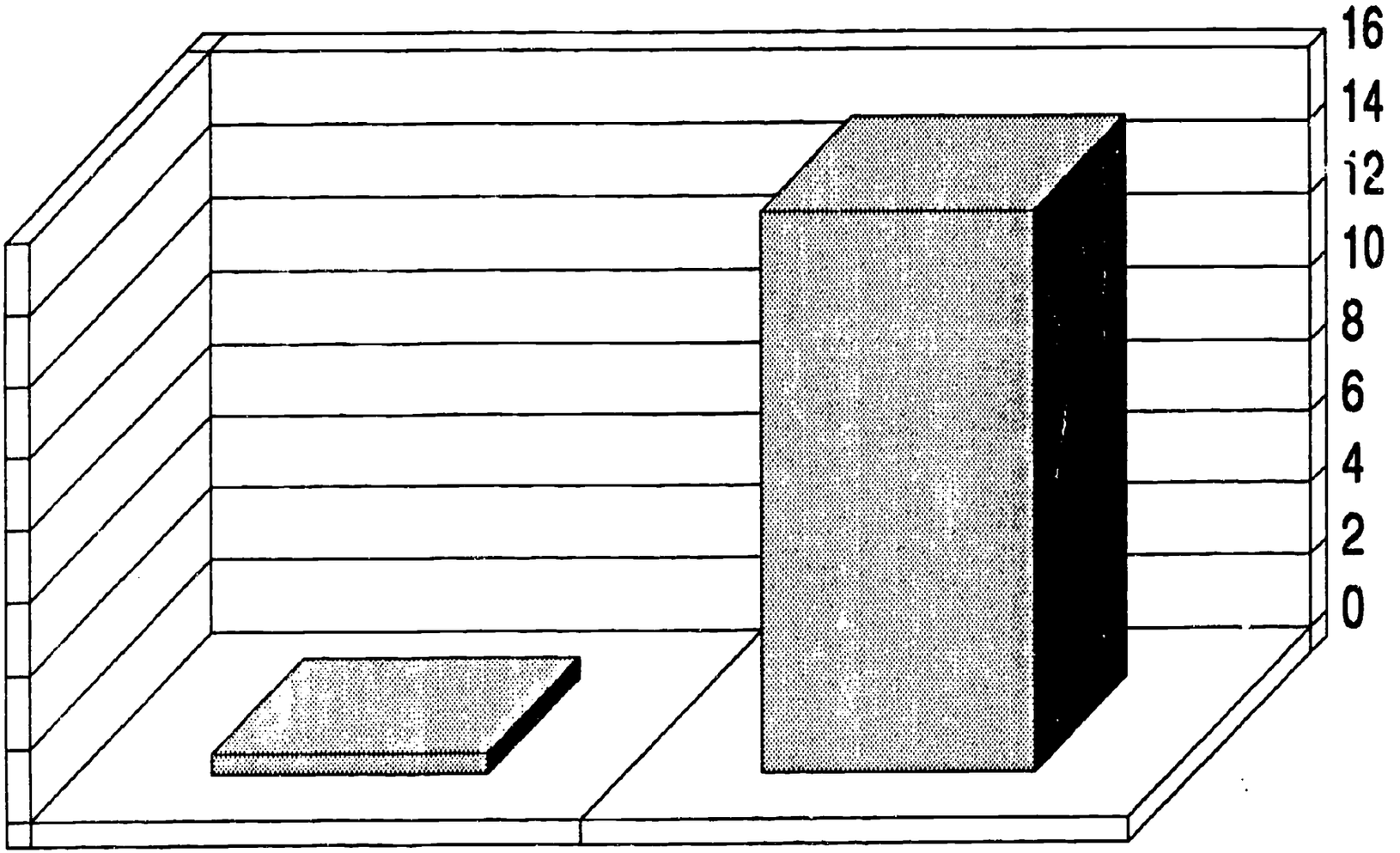
Art Libraries Association of North America
Bibliographic Instruction
BRS/Search Users
Business Librarians
Campus-Wide Information Systems
Circulation and Access Services
Conservation of Archive, Library, and Museum Materials
Data Research ATLAS Users
Discussion of Library Reference Issues
Geac Advance Library System
Government Documents
Innovative Interfaces Users
Interlibrary Loan
Law Librarians
Library Administration and Management
Library Automation in Greece
Library Cataloging and Authorities Discussion Group
Library Planning
Maps and Air Photo Forum
Medical and Health Sciences Libraries
Music Library Association
Notis Acquisitions Discussion Group
Notis and Other Rare Book Catalogers
Notis Music Library List
Notis Users
Public-Access Computer Systems Forum
Rare Books, Manuscripts, and Special Collections
Serials Users Discussion Group
SPIRES Users
Virginia Tech Library System Software
Z39.50 Implementors Workshop

DEVELOPMENT OF THE 'BACKBONE' NETWORK

- Late 1960s, 1970s - ARPANET, 56 Kbps lines
- 1980s - NSFNET, T1 lines at 1.544 Mbps
- 1990 - NSFNET/Internet, T3 lines at 45 Mbps
- Mid-1990s - NREN, 3 Gbps

TRANS CAP OF 56Kb & T1 NETWORKS

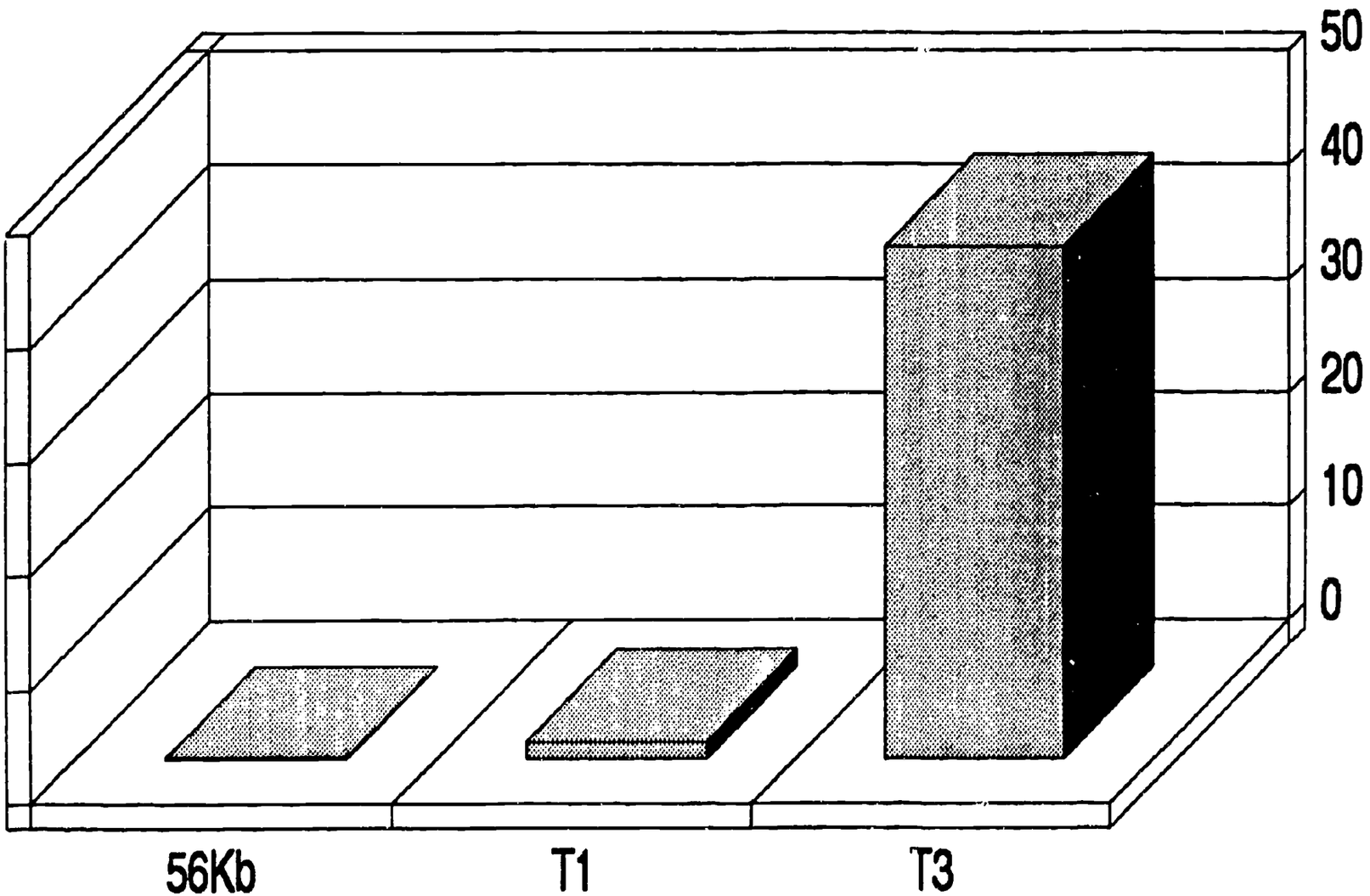
Kb/sec x 100



TRANSMISSION CAPACITY

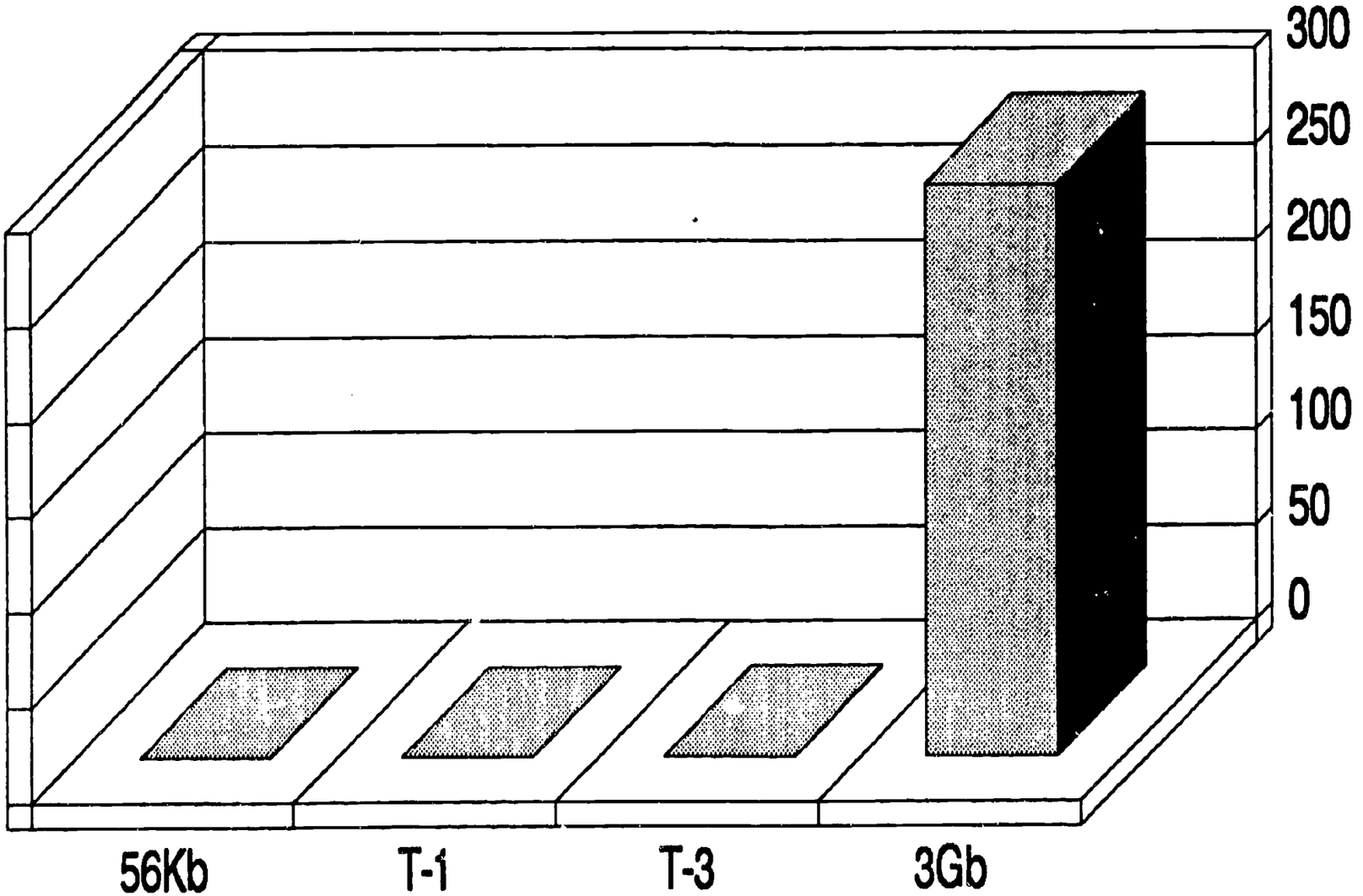
TRANS CAP OF 56Kb, T1, & T3 NETWORKS

Kb x 1000



TRANS CAP OF 56KB, T1, T3, & 3Gb NETWRKS

Kb/sec x 100,000



NSF-SPONSORED IP NETWORKS, JULY 1987

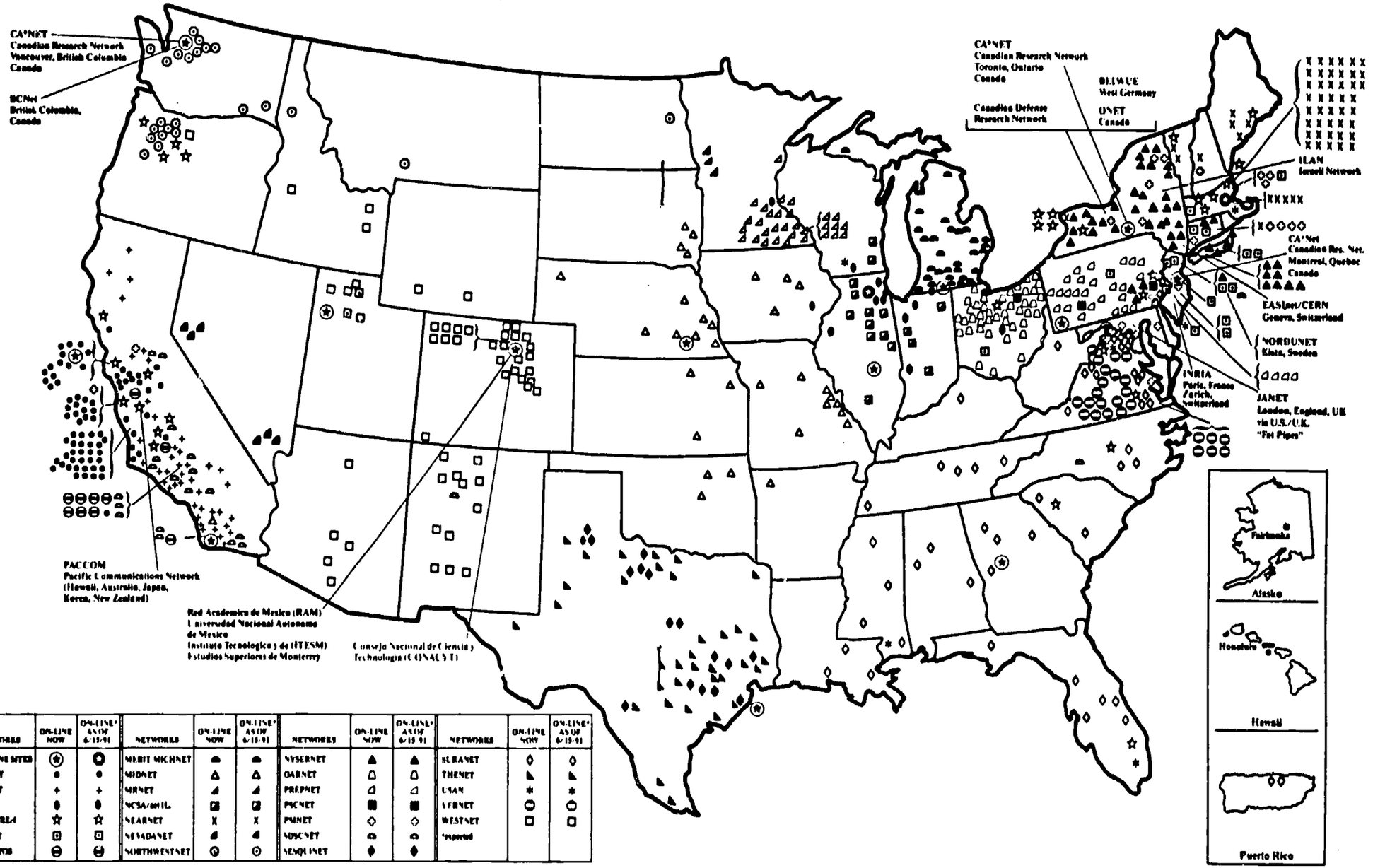
(NSF Network News, no. 1:6, July 1987)

NETWORKS	ON-LINE AS OF 5/15/87	ON-LINE* AS OF 11/15/87
BACKBONE SITES	★	★
BARRNET	●	●
CSNET	☆	
JVNCNET	⊡	
MERIT	◓	◓
MIDNET		△
NCSANET	◪	◪
NORTHWESTNET		◎
NSF-ARPANET	◢	◢
NYSERNET	▲	▲
PSCNET	■	■
SDSCNET	◒	◒
SESQUINET		◆
SURANET	◇	◇
USAN	*	*
WESTNET	□	

*expected

NSFNET MID-LEVEL WIDE AREA NETWORKS, FEB 1991

(NSF Network News, no. 9:4-5, Feb 1991)

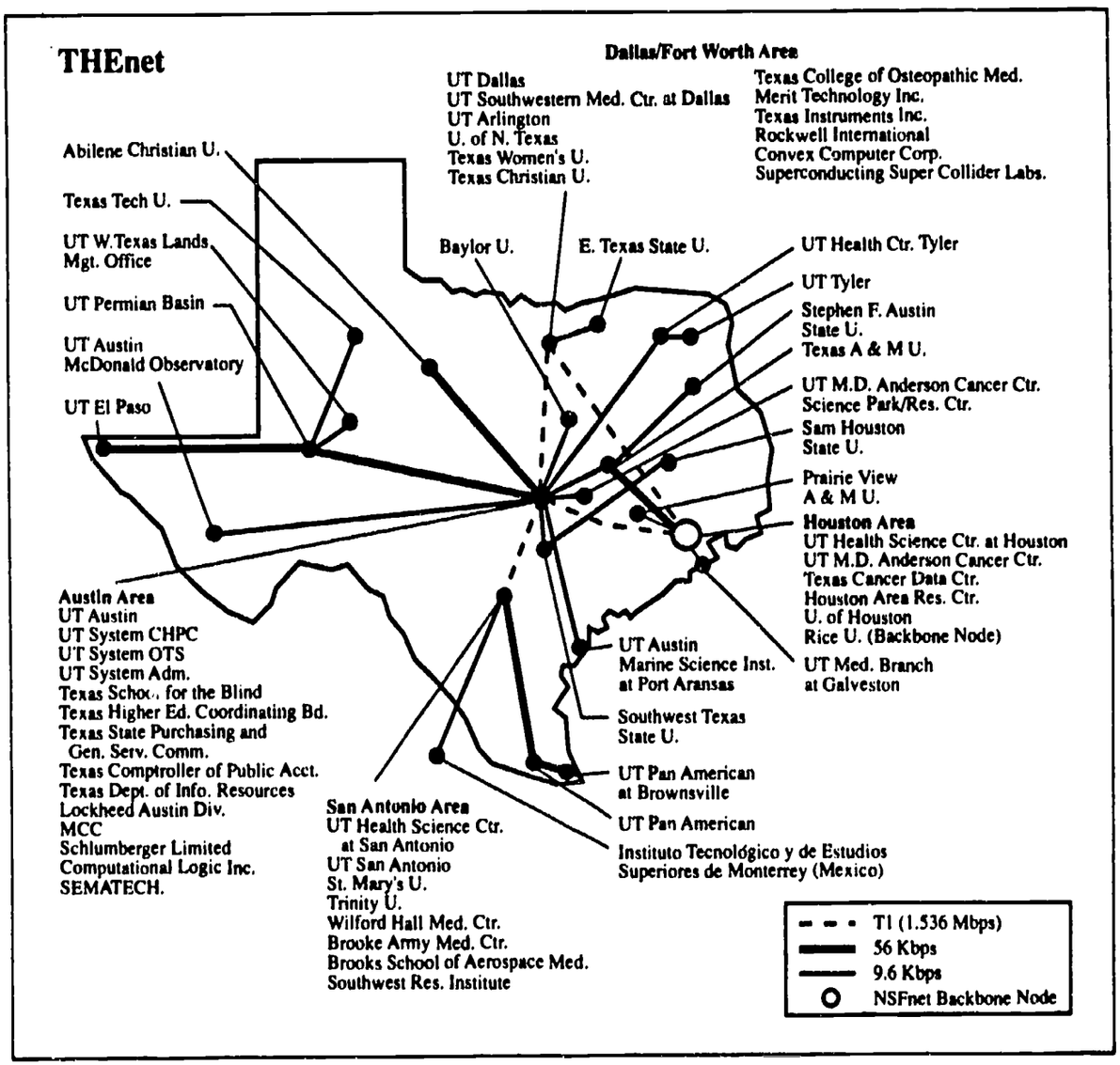


NETWORKS	ON-LINE NOW	ON-LINE* AS OF 6/15/91	NETWORKS	ON-LINE NOW	ON-LINE* AS OF 6/15/91	NETWORKS	ON-LINE NOW	ON-LINE* AS OF 6/15/91	NETWORKS	ON-LINE NOW	ON-LINE* AS OF 6/15/91
BACKBONE SITES	⊛	⊛	MERIT MICHNET	◓	◓	NYSERNET	▲	▲	SURANET	◇	◇
BARRNET	●	●	MIDNET	△	△	OARNET	△	△	THENET	◣	◣
CERFNET	+	+	MRNET	◢	◢	PREPNET	△	△	USAN	*	*
CICNET	◖	◖	NCSA/BITNET	◪	◪	PSCNET	■	■	VERNET	○	○
CONCERT	☆	☆	NEARNET	X	X	PWNET	◇	◇	WESTNET	□	□
JVNCNET	⊡	⊡	NEVADANET	◢	◢	SDSCNET	◓	◓	*reported		
LIN NETTOS	⊖	⊖	NORTHWESTNET	◔	◔	SESQUINET	◆	◆			

NREN and Information Democracy
R.D. Doctor, May 23, 1991

TEXAS HIGHER EDUCATION NETWORK (THENET), 1991

(NSF Network News, no. 9:9, Feb 1991)



MAJOR PROVISIONS OF S.272

- Develop a 5 year National High-Performance Computing Plan.
- Establish NREN as a "multi-gigabit-per-second" network by 1996.
- Phase NREN into commercial operation
- Provide for access to "electronic information resources maintained by libraries, research facilities, publishers, and affiliated organizations".
- Allow use of Federal research "grant monies to pay for networking expenses".
- Expand NSF's role in research and training in the library and information sciences.
- Authorize appropriations of $1.019 *billion* from FY 1992 through 1996 for HPCP.

Nam et ipsa scientia potestas est
Knowledge itself is power

Francis Bacon, 1597

DEMOGRAPHICS AND EQUITY: SPECIAL POPULATIONS

OUT OF 240 MILLION AMERICANS

- 27% (64.8 million) live in rural areas
- 14% (32.4 million) are below poverty level
- 24% (58.4 million) are in school
- 12% (29.8 million) are over 65 years of age
- 11% (27 million) over age 16 are disabled

OMB PROJECTIONS FOR THE YEAR 2000

- 2/3 of American households will own personal computers
- 6 to 8 million businesses will access electronic databases
- 40 to 50 million households will access electronic databases

COMPUTER OWNERSHIP AND USE
SOCIAL IMPACTS

- Microcomputers provide significant educational advantages
- Computer ownership and use divides along ethnic and income lines
- Student competence correlates with parental education
- Students in nonpublic schools demonstrate superior competence
- Structural gap exists between rural and urban environments

METAPHORS FOR NREN DEVELOPMENT

- Railroad
- Interstate Highway
- Telephone

THE RAILROAD METAPHOR

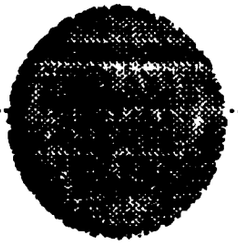
- Private sector ownership and operation
- Private sector development and funding.
- Development timetables and access rules established private sector.
- Rates, services and fees set by private sector.

COVER OF MARK ROSE'S BOOK

BT 1

INTERSTATE HIGHWAY

NO ACCESS

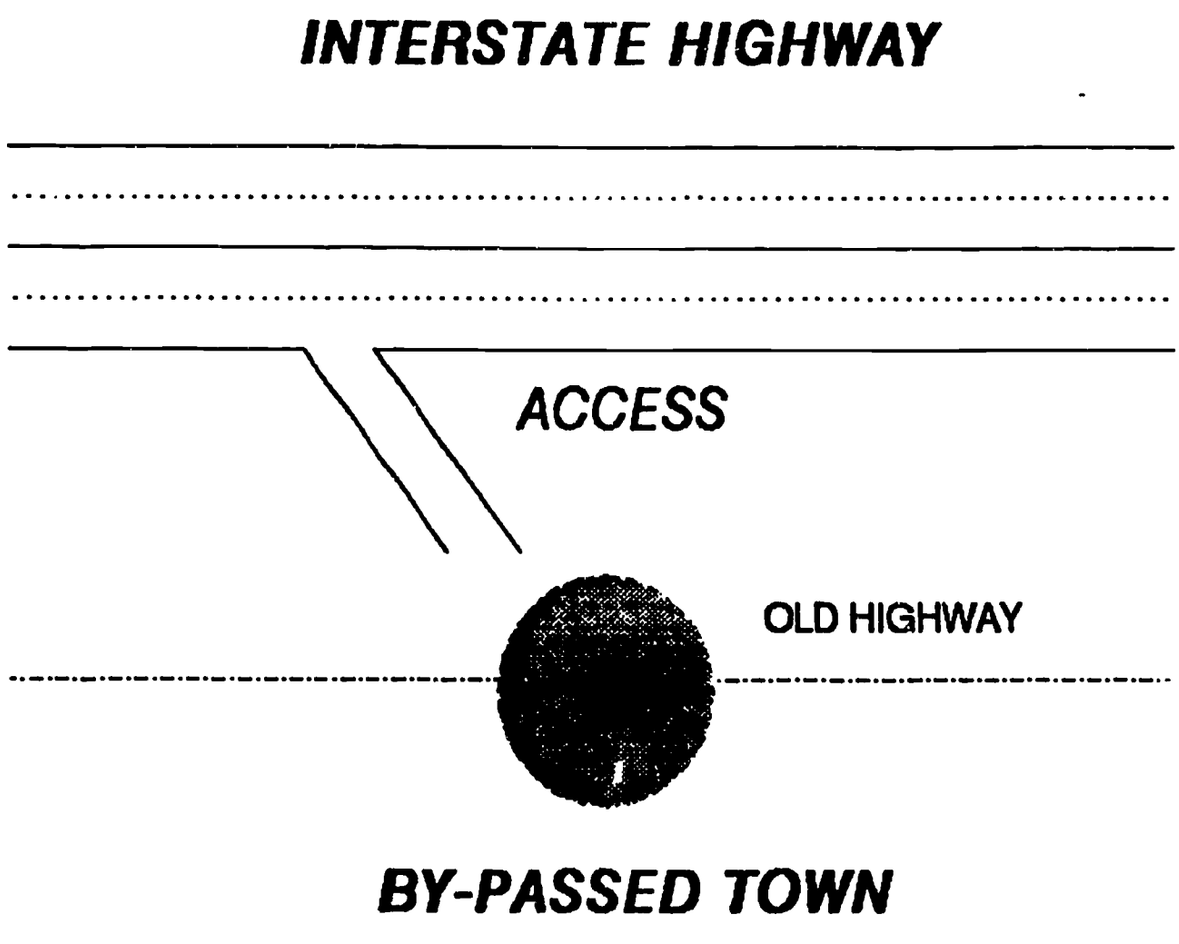


OLD HIGHWAY

BY-PASSED TOWN

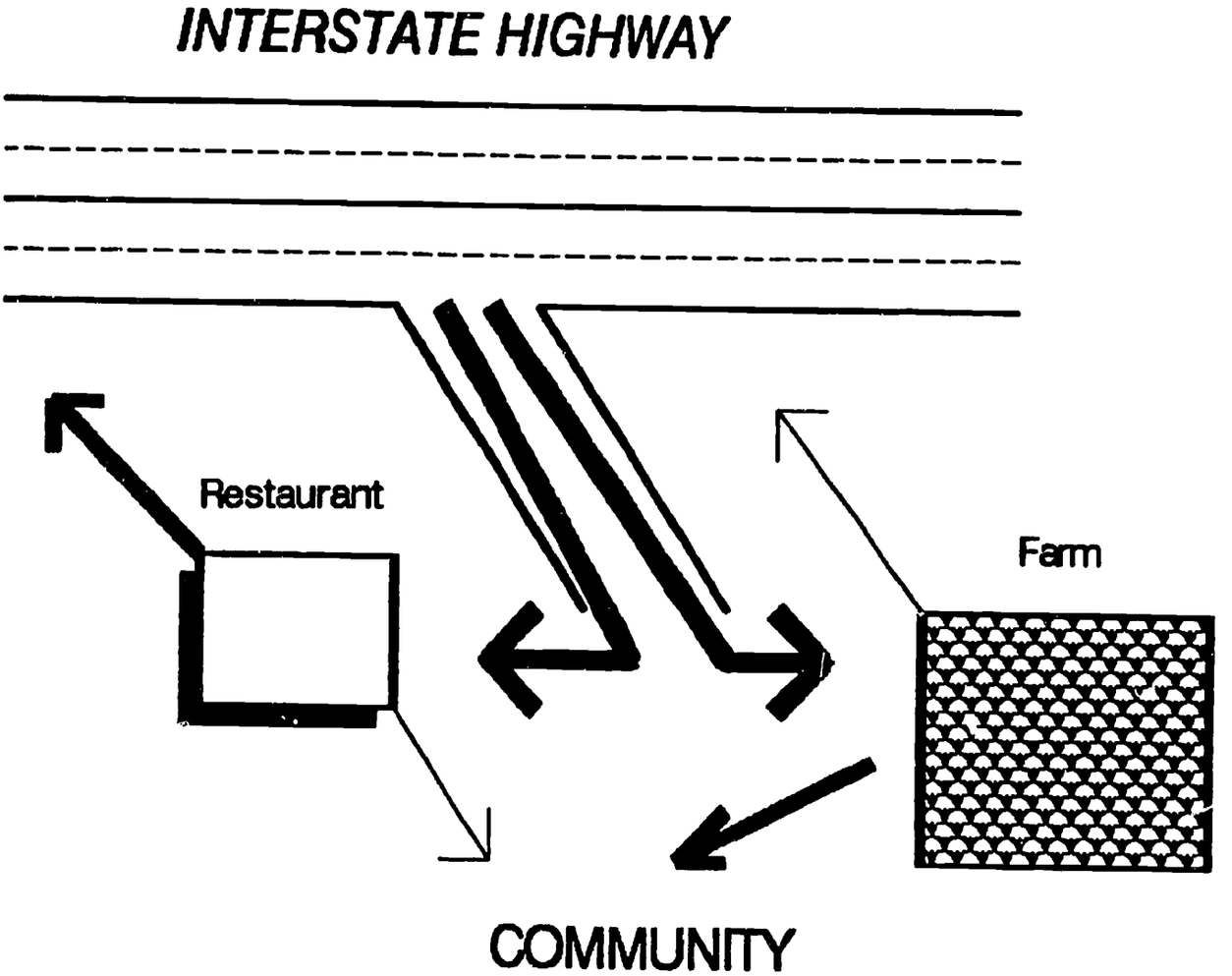
NREN and Information Democracy
B.D. Doctor & P.M. Turner, May 23, 1991
Chart 25

PT2



NREN and Information Democracy
R.D. Doctor & P.M. Turner, May 23, 1991
Chart 26

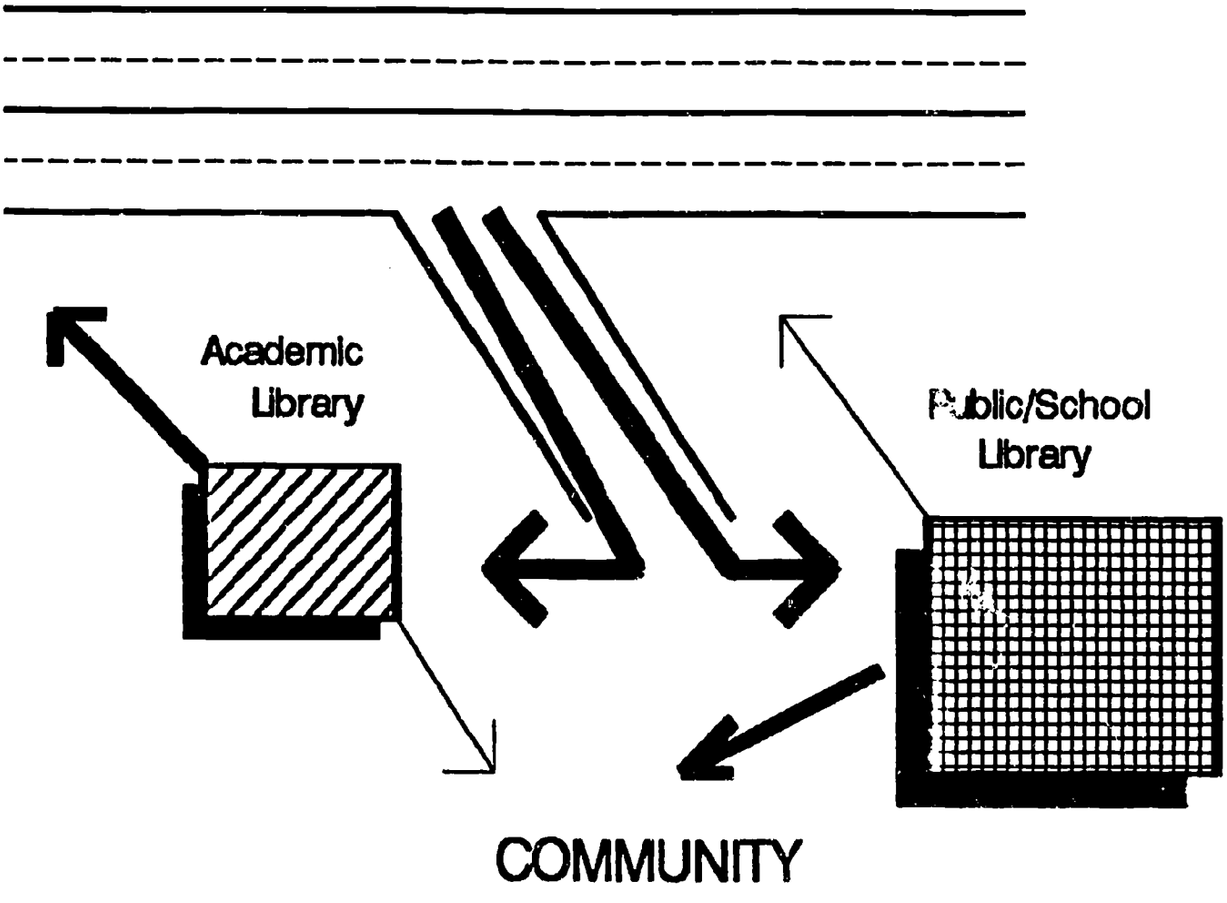
PT 3



ECONOMIC IMPACT OF ACCESS

pT4

INFORMATION SUPERHIGHWAY

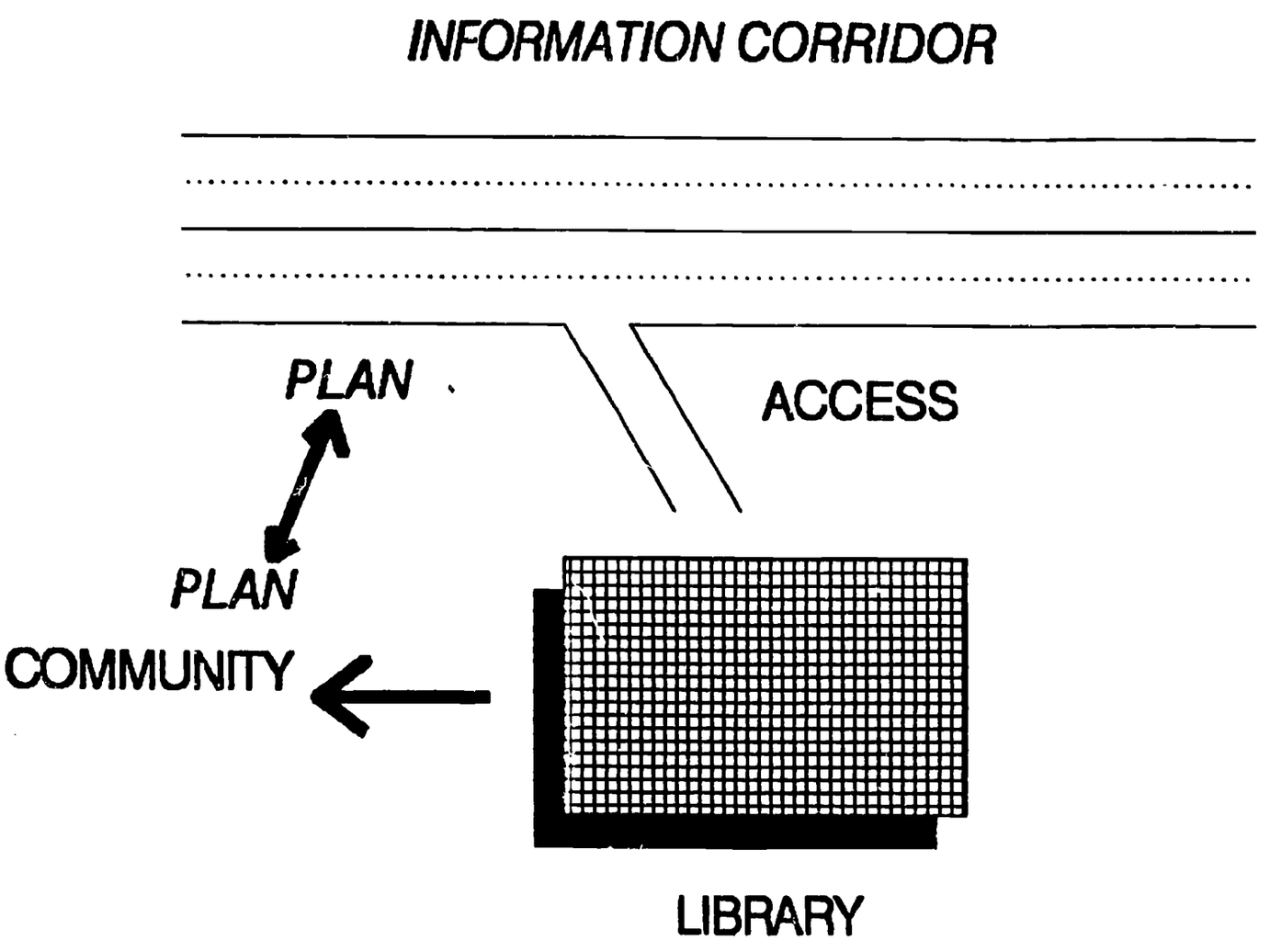


IMPACT OF INFORMATION ACCESS

NREN and Information Democracy
R.D. Doctor & F.M. Turner, May 23, 1991
Chart 28

ACTIONS FOR ACTIVISTS

- Legislative amendments: Provide for public interest representation on advisory committees.
- Incorporate Universal Service concept in NREN.
- Provide for free, or very low cost, access: schools, libraries, non-profits.
- Create useful and usable interfaces and applications for non-technical users.
- Provide training and assistance programs for non-technical users.
- Ensure public sector oversight of a commercialized NREN


INFORMATION CORRIDOR
PLAN
ACCESS
PLAN
COMMUNITY
LIBRARY

PMT'S "SOCIAL AND ..."